

April 14, 2021

VIA ELECTRONIC MAIL

The U.S. Environmental Protection Agency has completed review of the draft *APPENDIX X FISCAL YEAR 2021 FISH TISSUE SAMPLING IN BEAR CREEK IN SUPPORT OF THE DISPUTE RESOLUTION AGREEMENT FOR RADIOLOGICAL DISCHARGE LIMITS (DOE/OR/01-2457&D4) ERRATUM FY21-BCV-01*.

This erratum to the *Bear Creek Valley Watershed Remedial Action Report Comprehensive Monitoring Plan Oak Ridge, Tennessee (DOE/OR/01-2457&D4)* includes information supporting the EPA Administrator's decision (December 31, 2020) regarding a fish study in Bear Creek to assess radionuclides in fish tissue. The revised document (comments below) will identify existing bioaccumulative radionuclide contamination in fish along Bear Creek, the risk to fishermen, and support the development of risk-based radiological discharge limits for the Environmental Management Waste Management Facility (EMWMF) and the proposed Environmental Management Disposal Facility (EMDF). EPA comments must be addressed before this document can be approved.

EPA comments on the Appendix X, Fiscal Year 2021 Fish Tissue Sampling in Bear Creek in Support of the Dispute Resolution Agreement for Radiological Discharge Limits (DOE/OR/01-2457&D4) Erratum FY21-BCV-01.

General Comments

1. On December 31, 2020, the EPA Administrator issued his decision regarding the tri-party Federal Facilities Agreement (FFA) formal dispute on radionuclide wastewater discharge from the EMWMF. While the decision resolves the FFA dispute, it is not a “Dispute Resolution Agreement (DRA).” Please remove all references to a DRA in this document and reference the EPA Administrator decision.

2. This document does not address the EPA Administrator’s decision regarding the assessment of radionuclides in fish tissue. The EPA Administrator decision states:

A. “...*the DOE has not evaluated the current level of radionuclides in the tissue of fish in Bear Creek or what that level may be if discharges are increased through construction of the new landfill. That fish tissue data (and assumptions based on expected discharges), as well as consumption data if radionuclides are found in fish tissue, are needed before site-specific information on fish consumption can be developed. Accordingly, this decision also provides direction on the collection of fish tissue data and, if needed, fish consumption data.*” (p. 3, italics added)

B. “*Radionuclides bioaccumulate so the fact that only small minnows exist at NT-5 does not mean exposure cannot occur.* The exact location of this point of reasonable maximum exposure will be determined based on where recreational fishing occurs or is reasonably anticipated to occur based on reasonably anticipated future land use, considering the DOE’s land use designations.” (p. 13, italics added)

C. “*Fish are present in Bear Creek and the DOE has fish tissue monitoring programs for Bear Creek for PCBs, mercury and other metals. However, at present, the DOE has not evaluated the current level of radionuclides in the tissue of fish in Bear Creek or what that level may be if discharges are increased through construction of the new landfill. That fish tissue data (and assumptions based on expected discharges), as well as consumption data if radionuclides are found in fish tissue, are needed before site-specific exposures can be estimated.*” (p. 13, italics added)

D. “*Consideration of site-specific factors will require site-specific information, including conducting a fish study to assess radionuclides in fish tissue and other media in Bear Creek, and evaluate fish consumption, exposure and risk assessment data, to help inform the development of PRGs for radionuclides at this site.*” (p. 14, italics added)

The EPA Administrator’s decision recognizes the need for the collection of fish tissue in Bear Creek. The discharge of radiologically contaminated wastewater from EMWMF operations at NT-5 has been ongoing since 2007. Fish collection and contaminant assessment for mercury and PCBs have been conducted annually by the DOE through its Biological Monitoring and Abatement Program (BMAP) along Bear Creek. While no BMAP fish collection location occurs at NT-5, there is a collection point approximately one kilometer downstream at BCK 9.9. **Since the fish present at this location (BCK 9.9) are exposed to radiological discharge from the EMWMF, the EPA wants DOE to determine the level and type of radionuclides in fish tissue at this location using fish fillets and whole fish.**

An assessment of radionuclides in fish living in Bear Creek should include fish collected upstream of the EMWMF and associated areas of radiological contamination (e.g., BYBY). **Therefore, EPA wants fish collected (whole fish and fish fillets) from Bear Creek biological monitoring station BCK-12.4 to be analyzed for radionuclides.**

Recent studies suggest that **whole fish** caught specifically from Bear Creek are a part of the fishermen population diet (Campbell et al., 2002; Burger and Campbell, 2008). This manner of fish consumption could increase the possible radiological exposure experienced by an individual. **Therefore, EPA wants a subset of all fish collected in Bear Creek for fillets to be processed whole and analyzed for possible radionuclides contained within them.**

The additional sampling locations and the analysis of the whole fish conveyed in these comments will need to be added to this document in the appropriate sections.

The EPA recognizes this specific sampling event will only reflect the current conditions of possible radionuclide contamination for fish in Bear Creek. The longer-term monitoring of the potential impact that the EMWMF and proposed EMDF will have on Bear Creek will require that water, fish, and sediment be analyzed for the defined radiological contaminants of concern. This work will occur either through the modification of the CMP or from another primary document (e.g., RER and the Five-Year Review).

Specific Comments

1. Section 1, Introduction: Part of the purpose of the fish sampling and analysis activities is to determine whether the muscle tissues from commonly consumed fish, collected from Bear Creek, contain radionuclides that would adversely affect recreational fishermen. Please make this clear in the revised document.

2. Section 2. BACKGROUND, p. 1, 2nd paragraph: Add a statement that Bear Creek is classified by TN regulations for recreation. Cite the TDEC 0400-40-04 Use Classifications for Surface Waters which is used to designate Bear Creek for fish and aquatic life, recreation, livestock watering and wildlife and irrigation uses.

3. Section 2. BACKGROUND, p. 1, Third paragraph, first sentence: Please modify the text to indicate that the sampling plan is to provide direction on the collection of fish tissue data along Bear Creek relative to the EMWMF, identify potential fishing sites where fishermen may catch fish for consumption and define the human health risk to determine the safe levels that radionuclides can be discharged from the EMWMF and proposed EMDF.

4. Section 2. BACKGROUND, p. 1, third paragraph: The text states:

“Fishing is expected to be limited because edible, catchable game fish are typically small, conservatively around 30 g (1 oz), and many fish must be caught and combined to obtain a meal.”

Comment: This sentence needs to be clarified. The previous paragraph states no fishing is allowed. If fishing does occur then DOE believes they are too small (30 g or 1.0 oz) and multiple small fish would have to be collected to create enough fish fillets for a single human meal (what is the number of fish? – add to this sentence please). Also add that some fishermen cook and eat the whole fish collected from Bear Creek (see Campbell et al., 2002; Burger and Campbell, 2008).

5. Section 2, Background (3rd Paragraph): Please explain in this section why the larger game fish in nearby waterbodies are not expected to enter and feed on the smaller fish at the three Points of Exposure (POE) locations along the lower reaches of Bear Creek identified for the fish study (e.g., fish survey, water depth,

upstream, etc.)? Supporting information is needed as to why the fish in these locations are described as “typically small in size”. For example, this may be based on observance of fish in Bear Creek or previous fish collection activities in Bear Creek - cite BMAP report(s) as appropriate.

6. Figure 2, p. 3: Please add or identify the following: 1) Outline of EMWMF, 2) Outline of proposed EMDF, 3) NT-5, 4) NT-10, 5) NT-11. Please include the locations of the EMDF and EMWMF landfills on this figure to allow for better understanding of the positioning of the landfills relative to the background locations and existing biota sampling locations in Bear Creek.

7. Section 3.1.1 Sample Locations, p. 4, First paragraph: The text states:

“Fish will be collected from three POEs (BCK 3.3 -4.5, BCK 0.5 – 1.5, EFK 0 – 1.0) as identified in the DQO (Sect. 4) and two reference locations (Hinds Creek and Brushy Fork). Figure 2 shows sample locations and historical past biota sampling locations. The Figure 2 inset shows the reference locations.

Comment: This sentence should be rewritten to reference both Figure 2 and Figure 3 as appropriate.

8. Section 3.1.1 Sample Locations:

- a. For radionuclide analysis in fish tissue (and sediment and water): 1) include at least one existing BC biological monitoring location to represent BC upstream of EMWMF; 2) add additional sampling location immediately downstream of EMWMF in perennial part of BC, and 3) add a sample location immediately downstream of future location of EMDF. DOE should establish background within BC for each CERCLA landfill (i.e. upstream of EMWMF and between EMWMF and EMDF).
- b. Once current conditions in fish, SW and SD are established for radionuclides at these locations, these locations should be regularly monitored to assess impact of the landfills to BC. This erratum is for a one-time sampling event; therefore, this comment can be addressed via another means (revision to the CMP, RER, 5YR).
- c. “Brushy Fork is the best analog reference stream comparable to Bear Creek since headwater baseflow derives from Bacon Spring, which emanates from Maynardville Limestone at the base of Black Oak Ridge and further downstream, the main stem drains Conasauga Group/Rome Formation from basins up in Marlow and above on the flank of Walden Ridge.” Punctuation or transition word needed in this sentence.

9. Section 3.1.1, 2nd Paragraph: Given the Brushy Fork and Bear Creek have similar habitat (and hydrogeology), is there a reason to retain Hinds Creek as a reference location for radionuclide fish sampling? A statement should be added to this section explaining why Hinds Creek was retained as an analog reference stream despite Brushy Fork being the best analog reference stream for the fish sampling in Bear Creek. Notably, Section 3.1.2 (1st sentence) does not identify Hinds Creek as a reference location but doesn’t state why until the following page (page 5) in Table 1 where it then states, “fish population already performed.”

10. Section 3.1.2 Fish Population Surveys, p. 4, First paragraph: The text states:

“Fish will be collected from three Points of Exposure (POEs) (BCK 3.3 -4.5, BCK 0.5 – 1.5, EFK 0 – 1.0) in Bear Creek/Poplar Creek and reference location Brushy Fork. These locations have similar habitat and fishers have potential to access these reaches. The assumption is that all fish species are equivalent for human consumption (i.e., sunfish, bass, and catfish).”

Comment: Previous section used POE (see comment #7 above) but did not spell out the acronym. Please modify text to be consistent. The sentence references three POE but an examination of Figure 3 explains why a dash occurs between the points – it is actually the stream reach between the points. Please modify the text to clarify and make this change throughout the document where the stream reaches are referenced. No reference is made

to Hinds Creek – please add.

11. Section 3.1.2 Fish Population Surveys, p. 4, Third paragraph: The text states:

“Fish tissue will also be collected at this time for analyses (see Sect 3.1.3) Sample size needed is ~ 40 g (1 oz) of fillets based on the number of radionuclide analyses and the gram size required. Typical fish to be collected are at least 4.5 in. and weigh 30 g producing 10 to 12 g of fillet. Approximately 8 to 10 samples are preferred at each location in order to perform statistical analysis of the data.”

Comment: This sentence is confusing and should be rewritten for clarity. Suggest the following – modify as necessary for accuracy:

Fish tissue will be collected for radionuclide analyses (see Sect 3.1.3). The necessary sample size is approximately 40 g (1.4 oz) of fish fillet. The typical size for most fish caught in Bear Creek is 4.5 inches in length and weighs 30 g (1.1 oz). These small fish can only produce 10 to 12 g of fillet which requires multiple fish for a single radiological sample. Additionally, approximately 8 to 10 fish tissue samples (40 g each) are necessary to perform a statistical analysis of the fish tissue data.”

12. Section 3.1.2 Fish Population Survey:

- a. Will DOE use the existing BMAP fish survey data? Fish surveys are regularly conducted at BCK 9.9 and 3.3, and reported in the annual BMAP reports. BMAP data (for example 2018, Appendix A) demonstrate a greater density of fish and greater fish biomass at BCK 9.9 than in BCK 3.3. Is that due to Beaver dams or does it occur naturally due to a deeper pool habitat?
- b. The Burger study indicates that some recreational fishermen cook and consume the entire (whole body) fish. This could create a higher radiological exposure than just using fish fillets to assess possible radionuclide contamination. Need to include whole body radionuclide analysis to determine possible risk to fishermen.

13. Section 3.1.2: In addition to the rationale provided, this section should also mention that the three chosen POEs were considered to be in areas of presumed highest concentrations immediately downstream of EMDF and EMWMF with habitat that could support catchable and sizable fish species. In addition, more information is needed on why sunfish, bass and catfish were the only fish species identified for the fish sampling. Further, this section should state the following:

- a. The steps taken if other fish species commonly consumed by recreational fishermen that meets the size criteria (30 grams by weight, 4.5 inches in length) is found in the fish sampling locations.
- b. The basis for the number of individuals sampled for each species (e.g., fish population surveys, frequency or relative frequency of local consumption, Campbell et al., 2002; Burger and Campbell, 2008). The Campbell et al., 2002 and Burger and Campbell, 2008 fish consumption survey and patterns publications should be added to the list of references. Although 8-10 sample size is typically recommended for computing reliable statistics (USEPA, 2015), it should be noted that this is a minimal sample size requirement. To optimize the number of fish fillets available for compositing it is recommended that attempts be made to collect at least 30 small fish samples per fish species over the course of multiple sampling events. It is recommended that a stepwise approach be taken in the event of low sample sizes for estimating exposures, and to reach conclusions regarding the safety or absence of risk associated with chronic human fish consumption should be identified. This may include additional fish sampling events (perhaps at different times throughout the day or once in Spring and again in early summer) and selection of alternative fish sampling locations further downstream of Bear Creek where water flow can support larger fish. Applying the maximum concentration in the event of low sample size should be the last step taken to address low fish tissue yield.
- c. A similar statistical approach should be considered when using whole fish for radionuclide analysis.

14. Figure 3: It is difficult to pinpoint sampling location BCK 0.5 to BCK 1.5 on the figure. Please revise figure to better show this stream reach.

15. Section 3.1.3: Treatment of fish malformations/deformities (if found) should be discussed in this section. Any fish malformations/deformities should be recorded and not removed from the fish sampling and analysis. In addition, the fish sampling season selected should be identified in this section. Sampling should take place over multiple sampling events and be conducted during the optimal fishing season and time of day to increase fish sample size. Language describing when fish sampling will take place should be added to the document. Further, it is unclear why fish sampling is being limited to just two weeks and why alternative fishing locations of higher fish populations is not being considered in the event insufficient fish tissue is available for analysis after multiple attempts result in low yield. The reference to a “two-week period” should be removed and replaced with alternative fishing locations and/or additional weeks of sampling until sufficient fish tissue has been collected. See Comment 13b.

16. Section 3.2 Methods, p. 6: While the massive WRRP QAPP has been reviewed and approved by EPA, the necessary components of this specific sampling and analysis plan are not referenced or documented in a manner that allows for approval. Therefore, EPA will require DOE to provide a completed Uniform Policy Checklist to EPA for review before final approval of this document may occur. An electronic copy of the checklist can be provided upon request.

17. Section 3.3.2: Specify the COCs expected to be associated with background concentrations (e.g., uranium, radium, etc.). A distinction should be made between naturally occurring radionuclides and anthropogenic background concentrations for radionuclides in fish in the Oak Ridge area.

18. Table 4:

- a. Is this information already in the WRRP QAPP, or is it going to be added? The statement preceding the table is unclear.
- b. Page 9, Table 4 is mislabeled as “Table 3.”
- c. BFK 7.6, Is this monitoring location a single point? Or will it be a ~1 km stretch?
- d. In the Comments column, change “recreational receptors” to “recreational fishermen.” In addition, consideration should be made to sample fish in East Fork Poplar Creek since these fish likely migrate into Bear Creek. This would also ensure that the fish sampling size is adequate for determining potential risk.

19. Section 3.3.1 Fish Population Survey, p. 11: How will the fish population survey results be "converted" to fish consumption rate for a recreational fisherman (kg/yr or g/day, etc)? While this issue does not have to be resolved in order to proceed with the fish tissue collection event, it will have to be addressed before water quality-based effluent limits are established.

20. Table 6:

- a. D1.2, evaluation method: “This will be the point of departure for the other points.” Please clarify; what does this statement mean?
- b. D1.2, existing inputs:
 - i. The text includes “FY20 Bear Creek fish survey.” Is this the annual BMAP report? Please share this survey with EPA.
 - ii. Will the Campbell et al., 2002 and Burger and Campbell, 2008 studies be used?
- c. D1.2, additional information needs:
 - i. The text reference slide 58; it should be slide 61.

d. D1.4, decision element:

- i. The cause of radionuclides in background reference areas is an interesting question, but does not have to be answered for our purposes here.
- ii. DOE will need samples in BC upstream and downstream of each landfill to assess the impact of each landfill to BC.

21. DQO Step 4:

- a. While the fish population survey can be limited to the three proposed locations, we need radiological samples (fish tissue, SW, SD) upstream from EMWMF, between EMWMF and the proposed EMDF location, and near the future EMDF outfall to BC in order to establish a baseline for future comparison, and for attribution purposes. That said, some of this can be accomplished in a different sampling event in support of the RER and 5YR for the EMWMF.
- b. The text states "... fish concentrations are more sensitive to annual concentrations than singular events." Please clarify. Annual concentrations of what? Radionuclides in sediment/water?
- c. Are the three locations posted with signage prohibiting fishing and subject to security, including BCK 0 to 4.5? I thought the signage and security was further upstream.

22. DQO Step 5:

- a. First of three components – this statement changes based on the actual sample collection results, information collected from BCK-9.9 and BCK-12.4, and the whole fish body subset.
- b. The second and third components make no sense. Please rewrite for clarity.
- c. D1.1: Further discussion on whether the use of a dilution factor is appropriate, and if so, the methodology for determining the dilution factor, is pending.
- c. D1.4:
 - i. The text states: "What is the existing baseline risk in fish at the point(s) of exposure?" Please revise to "What is the existing baseline risk in fish to a recreational fisherman at the point(s) of exposure?"
 - ii. The cause of radionuclides in background reference areas is an interesting question, but doesn't have to be answered for this particular effort.
 - iii. Add: What are the existing fish tissue concentrations (current conditions) in Bear Creek upstream of the EMWMF (BCK-12.4), at BCK-9.9, and the downstream sampling locations?

23. Section 5 ADDITIONAL COCS CONSIDERED: Note that this section should be more than a summary paragraph unless the draft table provided during the April 8th, 2021 call to discuss the COCs to be analyzed in fish tissue is included in the appendices. As discussed during this call, this section will also need to include the basis for removing Cs-134.

24. Section 6 SUMMARY: This section will need to be revised to include the additional fish sampling at BCK-9.9 and BCK-12.4 and the addition of whole fish collected for radionuclide analysis should be discussed (see Campbell et al., 2002 and Burger and Campbell, 2008).

References Cited

K.R. Campbell, R.J. Dickey, R. Sexton, and J. Burger. 2002. Fishing along the Clinch River arm of Watts Bar Reservoir adjacent to the Oak Ridge Reservation, Tennessee: behavior, knowledge and risk perception. *The Science of the Total Environment*, 299: 145-161.

Burger, J. and Campbell, K. 2008. Fishing and consumption patterns of anglers adjacent to the Oak Ridge Reservation, Tennessee: higher income anglers ate more fish and are more at risk, *Journal of Risk Research*, 11:

335-350.